ANALYSIS OF FINANCIAL INNOVATION, INFRASTRUCTURAL DEVELOPMENT AND PERFORMANCE OF COMMERCIAL BANKS IN NIGERIA

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Abstract
This study examined the analysis of financial innovation and infrastructural development and performance of commercial banks in Nigeria during the period 2013 to 2024.The study adopts the quantitative method of analysis using secondary data from the Central Bank of Nigeria (CBN) statistical bulletin 2024. Financial innovation was measured from the perspective of payment innovations such as automated teller machine, point of sales (POS), and mobile payment systems. On the other hand, infrastructural development was measured by electricity supply. The study employspanel data model, which is anchored on the theory of task technology fit, Schumpeter's theory of innovation, and Frischmann infrastructure theory which is vital in examining the analysis of financial innovation and infrastructural development on the performance of banks. The data was analyzed through the use of the fixed effects panel data estimator. Findings of the study revealed that automated teller machine and mobile payment systems had a positive but statistically insignificant impact on the performance of banks in Nigeria, while the impact of the point of sales payment system was found to be negative and statistically insignificant. The study also found that the number of employees of banks had a negative and statistically insignificant impact on their performances.This study among other recommendations, strongly propose that, banks should shift their strategies from deploying more ATMs, mobile platforms, and POS machines to integrating and optimizing their usage.
Keywords: Financial Innovation, Infrastructural Development, Commercial Banks
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1. Introduction

Nigeria is one of Africa's largest economies, and has seen significant evolution in its banking sector over the past few decades. This evolution is largely attributed to financial innovation and infrastructural development, both of which are fundamental in advancing the performance of commercial banks. Financial innovation refers to the creation of new financial products, services, or processes, while infrastructural development encompasses the physical and institutional frameworks that support banking activities. Infrastructure on the other-hand plays a major role in the economy of a country whether developed or developing. The need for good infrastructure management is of great importance to the economies of countries all over the world and the various sectors of the economy needs to be understood. Financial innovations and infrastructural development play a vital role in the banking sector of developing countries. The bank in turn acts as a financial intermediary as well as a key source of financing for businesses and projects. Banks also ensure the efficient allocation of resources in that they mobilize the funds for various productive activities in practice they transfer funds from those with surplus funds to those that need it for productive activities which in turn stimulate investments and improve infrastructural development.

The Nigerian financial system which comprises of the formal and informal sector contributes 30% to the country`s GDP (Nigeria GDP report 2018). Nigeria and many developing economies operate a cash based financial system, where the use of cash is the prevalent method of making payments. However, in 2012 the CBN adopted a modern financial system which is termed “cashless policy” characterized by the adoption and emergence of innovative methods of making payments such as automatic teller machine (ATM), point of sale (POS), electronic payment system, internet banking, mobile money, and easier processes of transfer of funds from net savers to investors of funds. Financial innovations have been established to improve banks performance and service delivery in the financial sector. Although financial innovation plays a positive role on the performance of banks in Nigeria some of the problems that have been associated with the adoption of financial innovation include lack of adequate financial literacy education, low rate of financial deepening, and financial inclusion, gender gap in account ownership, poor telecommunications in rural areas, low level of infrastructural development and inadequate security measures. Innovation based growth model of Aghion, Howitt, and Meyer-Foulkes (2005) indicates that financial development plays a vital role in creating and sustaining innovation-based economies.

A new product without a track record expands rapidly in a buoyant economy, and the uncontrolled embrace of the product could lead to catastrophe should the economy become depressed. Fraudulent activities with financial innovations are easier, more penetrating and faster. On the contrary, when banks fail in their financial intermediation function, we expect declining infrastructural development and financial innovations hence poor banking performance will result in bank failures and financial crises like those witnessed during the global financial crisis that began in 2007(Marshall 2009). This explains why banks are one of the most regulated sectors in the world today. Saunders (1994) notes that bank performance role in an economy is so significant that the collapse of a large bank would be worse than that of any other institution in an economy.

2. Literature Review

This section discusses the concept of financial innovation, infrastructural development, and commercial banks. The theoretical framework employs theories like Task Technology Fit, Schumpeter'stheoryofinnovation and Frischmann`s infrastructure theory which are very important in analyzing the performance of financial innovation, infrastructural development, and the performance of commercial banks in Nigeria.

2.1. Conceptual Literature

2.1.2 Financial Innovation

According to Tufano (2002) financial innovation is the act of creating and popularizing new financial instruments as well as new financial technologies, institutions, and markets. According to Lawrence (2010) financial innovation involves the design, development and implementation of innovative financial instruments and processes, and the formulation of creative solutions to problems in finance.
There are three categories of financial innovations namely process, product and institutional innovation. For the purpose of this study financial innovation is examined from the point of view of process innovation. In doing this, the study focuses on payment innovations such as such as automated teller machine (ATM), point of sale(POS) and electronic payment.

2.1.3 Infrastructural development

Infrastructural development is an area that significantly improvesthequalityoflifeforcitizens. Access to reliable public transportation, clean drinking water, and proper sewage disposal are essential to a healthy and productive

society. The World Health Organization (WHO) reports that better infrastructure can reduce illness and mortality rates, thus improving life expectancy. For example, countries that have invested in water and sanitation infrastructure have witnessed significant declines in waterborne diseases (WHO, 2019).

2.2. Theoretical framework

2.2.1 Theory of Task Technology Fit

According to Goodhue and Thompson in 1995 theory of task technology fit posits that Information Technology will most likely impact positively on individual performance and be used if the capabilities of information communication and technology (ICT) match the tasks that the user must perform,this suggests that the usefulness of financial innovation lies in the capability of the user and its value in helping the user achieve a certain purpose.

According to Goodhue & Thompson (1995), some factors that measure task-technology fit are: quality, locate-ability, authorization, and compatibility, ease of use/training, production timeliness, systems reliability and relationship with users. This model is useful to this study because of the diverse range of information systems including electronic commerce systems combined with or used as an extension of other models related to information systems outcomes, the theory maintains that for information system to be successful there must be a match between business tasks an information technology adopted. (Goodhue & Thompson, 1995; Zigurs&Buckland, 1998).

2.2.2 Schumpeter'stheoryofinnovation

The Schumpeterian theory of innovation was developed by Joseph A Schumpeter in 1934. According to the theory, the changes in investment accompanied by monetary expansion are the major factors behind the business fluctuations, but however, Schumpeter's Theory posits that innovation in business is the major reason for increased investments and business fluctuations.

According to Schumpeter, the cyclical process is almost exclusively the result of innovation in the organization, both industrial and commercial. By innovation Schumpeter means, the changes in the methods of production and transportation, production of a new product, change in the industrial organization, opening up of a new market, etc.

2.2.3 Frischmann`s infrastructure theory

Brett Frischmann (2004) posits that open access to infrastructure resources generates significant value for consumers and society. Brett Frischman's theory suggests that the benefits of open access and the corresponding costs of restricted access are significantly greater than reflected in current debates. Frischmann's infrastructure theory ultimately ties together different strands of legal and economic thought pertaining to natural resources such as lakes, traditional infrastructure suchas road systems, what antitrust theorists describe as essential facilities, basic scientific research, and the Internet. His theory has significant potential to reframe a number of important debates within intellectual property, cyber law, telecommunications, and many other areas.

3.Methodology

This study designed a methodology that ensures a structured, valid and reliable guide aimed at interpreting the results, in relation to the research questions and hypothesis that are captured in the interpretation of results. The study adopts the quantitative method of analysis using secondary data from the Central Bank of Nigeria (CBN) statistical bulletin 2024.

3.1. Research design

The study is based on the use of Ex-post facto design. The Ex-post facto design is a type of research design that enables the examination of the cause-effect relationship between variables from a historical perspective, based onthe use of past data on the variables.

The data utilized by this study is a micro-panel dataset. As such, the model earlier specified is estimated through the use of the fixed and random effects panel data estimators. According to Lam (2019), the difference between both estimators is the correlation or lack thereof between unobserved variables and observed variables. The fixed effects estimator isused when both variables are correlated, while the random effects model is used insituations where they are not. The choice between both estimators is determined on the basis of the Hausman test.

3.2 Model specification

The model for this study, which is a panel data model, is anchored on the theory of task technology fit, Schumpeter's theory of innovation, and Frischmann infrastructure theory which is vital in examining the impact of financial innovation and

infrastructural development on the performance of banks in Nigeria. Based on this, the model for the study is specified as follows:

$PATi,t=\beta0+\beta1logATM+\beta2logPOS+\beta3logMPY+\beta4logINR+\beta5logNOMi,t+\beta6logAGEi,t+ \beta7FNP + Ui,t$

The apriori expectations are: $\beta1>0,\beta2>0,\beta3>0,\beta4>0,\beta5>0,\beta6>0,\beta7>0$ Where:

LogPATi,t=Profit after tax of the ithbank in time t(used as proxy for the financial performance of banks) ATM= Value of automated teller machine transactions

POS= Value of point of sales transactions

MPY=Value of mobile payment transactions

INR=Infrastructural development (proxied by electricity supply)

NOM=Number of employees of the ithbank in time t

AGE=Age of the ith firm in bank

tFNP=Financial openness

Ui=Stochastic Error Term β0= Intercept

β1–β7=Slope coefficients of the independent variables

3.3 Description and measurement of variables

i. Profit after tax: This is used as a measure of the financial performance of banks in Nigeria during the study's period.

ii. Automated teller machine: An automated teller machine (ATM) is an electronic banking outlet that allows customers to complete basic transactions without the aid of a branch representative or teller. Anyone with a credit card or debit card can access cash.

iii. Point of sale: This is technically a system in a retail store from which you conduct the sale of physical goods.

iv. Electronic payment (mobile payment): This is a digital transaction between two parties, with e-payment types including ACH, cards, bank transfers, digital wallets, mobile pay, and more.

v. Age of banks: This is the number of years the banks under consideration have been inexistence from the date of their establishment. It is measured as the difference between the terminal year and the base year.

vi. Number of employees: This is the total number of employees in each of the banks under investigation.

vii. Infrastructural development:This is proxied by the amount of electricity supply the banks under consideration consumed.

viii. Financial openness: This refers to the extent of financial flows in the banking system. It is measured as banks' credit share to the GDP.

4. Results and Discussion

4.1. Descriptive statistics

The descriptive (summary)statistics of variables are as presented in table 4.1.For each variable, the tablereportsthe mean, median, maximum, minimum and standard deviation values. From the table, it can be seen that the mean values of PAT, ATM, POS, MPY, INR, NOE, AGE and FNP are 0.000000597, 0.0000000648, 0.0000000169,0.0000000107, 146.45, 5212.722, 42.8 and1605.026 respectively while the irrespective standard deviations are 0.000000634, 0.0000000210, 0.0000000143, 0.0000000108, 1.729026,3339.919, 15.22505 and 1107.885.

Table4.1Descriptive Statistics of Variables

Statistics	**PAT**	**ATM**	**POS**	**MPY**	**INR**	**NOM**	**AGE**	**FNP**
Mean	5.97e+07	6.48e+08	1.69e+08	1.07e+08	146.45	5212.722	42.8	1605.026
Maximum	2.45e+08	8.76e+08	4.39e+08	3.77e+08	148.56	13237	76	3709.77
Minimum	1596531	2.95e+08	9402255	1.58e+07	142.73	1011	23	-68.1
Std.Dev.	6.34e+07	2.10e+08	1.43e+08	1.08e+08	1.729026	3339.919	15.22505	1107.885
Observations	90	90	90	90	90	90	90	90

Source: Author's computation using STATA Software (2025).

4.2 Pairwise correlation coefficients results

The correlation matrix results from table 4.2 revealed the following nature and direction of correlation between the variables under consideration: that there is weak and positive correlations exist between ATM and PAT; that a weak and positive correlation exist between POS and PAT, but strong and positive correlation exist between POS and ATM; that a weak and positive correlation exist between MPY and PAT, but strong and positive correlation exist between MPY and ATM and POS; that a weak and positive correlation exist between INR and PAT, ATM, POS and MPY; that a weak and positive correlation exist between NOM and PAT, POS, MPY and INR, but a weak and negative relationship exist between NOM and ATM; that a weak and positive correlation exist between AGE and ATM, POS, MPY and INR, but a weak and negative relationship exist between AGE and PAT and NOM; and lastly, weak and negative correlation exist between FNP and PAT, MPY and AGE, while strong and negative correlation exist between FNP and ATM, POS and INR. FNP had positive but weak correlation with NOM. In summary, PAT had positive but weak relationship with ATM, POS, MPY, INR and NOM, while the relationship between PAT and AGE and FNP is weak and negative.

Table 4.2Correlation Matrix

	PAT	ATM	POS	MPY	INR	NOM	AGE	FNP
PAT	1.0000							
ATM	0.2419	1.0000						
POS	0.2262	0.8686	1.0000					
MPY	0.1647	0.6103	0.8905	1.0000				
INR	0.0846	0.4858	0.3645	0.3447	1.0000			
NOM	0.4469	-0.0209	0.0002	0.0144	0.0159	1.0000		
AGE	-0.4717	0.1521	0.1425	0.1131	0.0867	-0.1033	1.0000	
FNP	-0.1473	-0.5265	-0.5556	-0.4161	-0.6743	0.0018	-0.0977	1.0000

Source: Author's computation using STATA Software (2025).

4.3. Panel regression results

The fixed effect regression results in table 4.3 revealed that the a priori expectations were not fully satisfied. The slope coefficients of ATM, MPY and AGE are positive; suggesting that a percentage change in value of automated teller machine (ATM) transactions, value of mobile payment transactions (MPY) and age of bank (AGE) respectively increased profit after tax (PAT) by 189.7835 percent, 34.74644 percent and 416.5165 percent, ceteris paribus. On the other hand, the negative coefficients of POS, INR, NOM and FNP indicate that a percentage change in value of point of sales (POS) transactions, infrastructural development (INR), number of employees (NOM) and financial openness (FNP) respectively increased PAT by 76.64304 percent, 1764.898 percent, 27.37945 percent and 0.01331 percent.

The coefficientof determination (R^2) showsthat about40.29 percentof the variation in PAT was explained by the changes in the explanatory variables of the estimated model. This implies that the explanatory variables in the estimated model have weak explanatory power. However, the F-statistic value of 7.06 with probability value of 0.0000 indicates that the parameters of the estimated model are jointly or simultaneously statistically significant. This implies that the forecasting power of the estimated model is reliable.

Table4.3 Fixed Effects Regression Results

Dependent Variable: *ln* (PAT)

Variable	*Coefficient*	*StandardErrort-statistic*	*p-value*	
C	61.73593	29.18273	2.12	0.038
ln(ATM)	1.897835	1.53449	1.24	0.220
ln(POS)	-0.7664304	0.624706	-1.23	0.224
ln(MPY)	0.3474644	0.308263	1.13	0.263
ln(INR)	-17.64898	6.302	-2.80	0.007
ln(NOM)	-0.2737945	0.4037934	-0.68	0.500
ln(AGE)	4.165165	1.455423	2.86	0.005
FNP	-0.0001331	0.0000654	-2.03	0.046

DiagnosticChecks:

R-squared:0.4029

F (7,13) =7.06; Prob(F-statistic) =0.0000

Source: Author's computation using STATA Software (2025).

4.4. Random effect regression results

The regression results in table 4.4 revealed that the a priori expectations were not fully satisfied. The slope coefficients of ATM, MPY and NOM are positive; suggesting that a percentage change in value of automated teller machine (ATM), mobile payment transactions(MPY) and number of employees(NOM) respectively increased profit after tax (PAT) by 245.2718 percent, 47.53733 percent and 91.67209percent, ceteris paribus. On theother hand, the negative coefficients of POS, INR, AGE and FNP indicate that a percentage change in value of point of sale (POS) transactions, infrastructural development (INR), age of bank(AGE) and financial openness(FNP) respectively increased PAT by 72.53302 percent, 1727.592 percent, 128.243 percent and 0.01285 percent.

Table4.4 Random Effects Regression Results Dependent Variable: *ln*(PAT)

Variable	*Coefficient*	*Standard Error*	*t-statistic*	*p-value*
C	55.77028	31.7426	1.76	0.079
ln(ATM)	2.452718	1.695468	1.45	0.148
ln(POS)	-0.7253302	0.6931338	-1.05	0.295
ln(MPY)	0.4753733	0.3377596	1.41	0.159
ln(INR)	-17.27592	6.954619	-2.48	0.013
ln(NOM)	0.9167209	0.2390298	3.84	0.000
ln(AGE)	-1.28243	0.5162249	-2.48	0.013
FNP	-0.0001285	0.0000726	-1.77	0.077

Source: Author's computation using Stata Software (2025).

The Hausman test provides the basis of the choice between fixed and random effects models. The test is based onthe following null hypothesis:
H0: The individual-effects are adequately modelled by a random effect
The result of the test carried out with respect to the study model is presented in table 4.5. From the result, it can be seen that the probability value of the Hausman test Chi2 statistics of 0.0014 is less than the critical probability value of 0.05. On the basis of this, the null hypothesis of the Hausman test is rejected, the study therefore concludes that the individual effects are not adequately modelled by the random-effects. Based on this, the random effects model estimates are rejected and the fixed effects model estimate is accepted as the preferred results of this study.

Table4.5 The Hausman's test results

Test Summary	Chi-sq. Statistic	Chi-sq.df	Prob.value(pv)
	21.72	6	0.0014

Source: Author's computation using Stata Software (2025).

4.5 Test of hypotheses

The test of hypotheses is based on the probability values of the estimated regression parameters. The tests are carried out at 5 percent level of significance. The decision

rule is such that when probability value (PV) is less than 0.05, it indicates that the parameter is statistically significant. Thus, probability values greater or equal to 0.05 suggest that the parameter is statistically insignificant.

From the regression results in table 4.4, it can be observed that the impact of infrastructural development (INR), age of bank (AGE) and financial openness (FNP) on profit after tax (PAT) is statistically significant at 5 percent level of significance. On the other hand, the impact of value of automated teller machine (ATM) transactions, value of point ofsales (POS) transactions, value of mobile payment transactions (MPY) and number of employees (NOM) on PAT is statistically insignificant at percent level of significance.

5. Conclusion and Recommendation

This study is targeted to analyze financial innovation, infrastructural development, and bank performance in Nigeria from 2013-2024. Static panel regression models that address the objectives of the study were estimatedusing the fixed effect (FE) estimator. The fixed effect estimator was selected at the appropriate estimation technique through the Hausman's specification test. Findings from the regression analysis and test of hypotheses revealed that the various measures of financial innovation and infrastructural development had mixed impact on bank performance.

5.1 Conclusion

Based on the analysis of this work, the findings is that, Automated Teller Machine (ATMs), mobile payments, and Point of Sale (POS) systems have improved bank performance in Nigeria. These payment systems have also resulted in reduction of transactions costs and created more employment opportunities for many youths in Nigeria.

The most critical findings is that, infrastructural development has a significant negative impact of performance, indicating that the associated costs may currently outweigh the benefits. Furthermore, an increase in the number of employees is associated with lower profits pointing to patenting issues with operational efficiency. In essence, the major key to improving bank performance in this context lie not in expanding physical infrastructure, but optimizing their utilization and managing operational costs, particularly those related to infrastructure and human resources.

5.2. Recommendations

Based on the conclusion, the proposed recommendations is that, banks should shift their strategies from deploying more ATMs, mobile platforms, and POS machines to integrating and optimizing their usage.

Given the significant negative impact of infrastructural development, banks should critically assess the return on investment for new branches or major physical expansions.

The negative relationship between the number of employees and profit suggests issues with staff productivity, therefore, banks should invest in training to upskill employees, making them more productive in a digital environment.

Finally, Banks need a holistic strategy that will integrates ATMs, mobile banking, and POS systems into a seamless environment to aid the private sector access to credit and other forms of funds. This strategy aims at reducing overall operational costs, enhance customer retention, thereby translating technology presence into financial gain.

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